

THE ARCHITECTURE OF THE BLOOD VESSELS OF
THE RAT UTERUS UNDER THE INFLUENCE OF
ENDOGENOUS AND EXOGENOUS HORMONES

BY

MAUDE WILLIAMS

A.B., University of Illinois, 1924

M.S., University of Illinois, 1926

ABSTRACT OF THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN
PHYSIOLOGY IN THE GRADUATE SCHOOL OF
THE UNIVERSITY OF ILLINOIS,

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The effect of endogenous estrogen and progesterone on the vascular pattern of the uterus of the rat was studied in the normal, pseudopregnancy and pregnancy cycles; the effect of exogenous hormones was studied in immature and ovariectomized animals. More than one hundred and fifty immature and adult animals were used.

Various techniques were employed in the investigation which include:

1. Cornstarch and India ink or chrome yellow injections for observations of the general arrangement of the afferent and efferent vessels.

2. The vaginal smear method was used to determine the stage of the cycle.

3. Bilateral ovariectomy was performed on adult animals which were then injected with estrogen and progesterone. Animals used in studies of the pregnancy cycles were unilaterally ovariectomized.

4. The exogenous hormones were estradiol dipropionate and progesterone. The ovariectomized animals were "primed" one week with 1 gamma of estradiol dipropionate before the critical experiments were begun.

5. Preparation of sections. The animals were perfused with saline through the abdominal aorta then injected with India ink. The dissected reproductive tract was fixed in formalin, dehydrated in alcohol and cleared in oil of wintergreen. Free-hand sections chiefly of the middle segment were mounted for study and certain sections selected for photography. Some serial sections stained with haematoxylin and eosin also were prepared.

6. Manner of study. Over one hundred photomicrographs of cleared sections were assembled for comparative studies. These were continually checked with all of the sections of a specimen.

The basic or "resting" condition of the uterine vessels was established in (1) the twenty-one day old rat; (2) the diestrus of the normally cyclic female; (3) the ovariectomized adult; and (4) the ovariectomized "primed" with estrogen one week before the experiment. From this basic condition changes were noted towards vasodilatation and growth, with subsequent regression.

Estrogen, in physiological doses, results after several days of injection in a well developed, somewhat edematous uterus supplied by a rich network of rather fine vessels. The greatest dilatation seen was in uteri stimulated by a combination of estrogen and progesterone.

Of special interest in the physiology of the uterus is the correlation of changes which occur in the vascular bed with the changes in size of the organ as a whole and both phenomena with the probable hormone level of the blood.

The increase in size of the uterus may be due (1) to accumulation of intercellular fluid within the tissues, both endometrium and myometrium, (2) to accumulation of fluid in the lumen of the organ, and (3) to hyperplasia or real growth by cell division.

Putting together the observations of the sequence of events which concern us here we may state that estrogen is influential in producing early changes in the vascular pattern, edema, and mitosis. Progesterone intensifies the effect of estrogen on blood vessels of the endometrium, minimizes it on the capillaries of the myometrium, and augments cell division. It does, however, antagonize the effect of estrogen on water imbibition in agreement with Astwood. Progesterone alone was observed not to influence the vascular architecture.

In the sequence of functions estrogen and progesterone act on the uterus of the rat to produce an early vasodilatation, followed by edema, and subsequently by cell division.

X. VITA

Maude Ferrell Williams was born October 23, 1896, in Iola, Illinois, where she lived until 1912, when she attended the Southern Illinois Normal University at Carbondale, for two years. In 1915 she accepted a civil service appointment at Washington, D. C. where, also, she attended George Washington University. In 1921 she studied at the University of Illinois, receiving an A.B. degree in 1924 with a major in Home Economics and an M.S. degree in 1926 from the same department with a minor in Physiology.

While a graduate student and until 1928 she was an assistant in the Department of Physiology, University of Illinois, under Professor W. E. Burge, under whom she did research and with whom she has collaborated in several publications. In 1928 she accepted a position to teach physiology in the Department of Biology, Woman's College of the University of North Carolina, at Greensboro, attaining the rank of associate professor in 1936.

Several summers have been spent in study at the Universities of Illinois and Chicago, one as a student and assistant at the Illinois Research and Educational Hospitals in Chicago. Under the direction of Professor A. J. Carlson, studies in basal metabolism were begun at the University of Chicago and continued at Woman's College, U. N. C.

In 1944 she obtained a leave of absence from her duties at Woman's College and since then has been studying and teaching in the Department of Zoology-Physiology, University of Illinois.

Honorary and professional societies that she belongs to are: Iota Sigma Pi, Phi Sigma, Sigma Delta Epsilon, Sigma Xi (associate), A. A. A. S. (Yellow) N. C. Academy of Science, A. A. U. P.



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